

Suspected Rabies Exposure

1. DISEASE REPORTING

A. Purpose of Reporting and Surveillance

1. To assist in the prevention of human cases of rabies.
2. To offer rabies post-exposure prophylaxis (PEP) and provide counseling to those who were exposed to a rabid, or potentially rabid, animal or human.
3. To facilitate the capture and confinement of potentially rabid animals (involved in a human exposure) which have a defined observation period (dogs, cats, and ferrets); or facilitate histological examination of the brain of potentially rabid animals (involved in a human exposure) for animals that cannot be observed.

B. Legal Reporting Requirements

Under the 2011 notifiable conditions rule revisions, the Washington Administrative Code (WAC) was modified such that reporting of all animal bites is no longer required; instead, only those situations in which human exposure to rabies is suspected are reportable to the local health jurisdiction (LHJ). For the purposes of reporting, “Suspected Rabies Exposure” includes two conditions listed in the 2011 rule revisions:

- Rabies, suspected human exposure (due to a bite from or other exposure to an animal that is suspected of being infected with rabies); and
 - Animal bites (when human exposure to rabies is suspected).
1. Health care providers: **immediately notifiable to local health jurisdiction.**
 2. Health care facilities: **immediately notifiable to local health jurisdiction.**
 3. Laboratories: Rabies virus (human or animal specimen) **immediately notifiable to local health jurisdiction**; specimen submission required – clinical specimen associated with positive result (2 business days).
 4. Veterinarians: suspected human case or exposure or animal case **immediately notifiable to local health jurisdiction**; animal cases (excluding bats) also notifiable to Washington State Department of Agriculture (<http://apps.leg.wa.gov/WAC/default.aspx?cite=16-70>).
 5. Local health jurisdictions: notifiable to the Washington State Department of Health (DOH) Communicable Disease Epidemiology Section (CDES) within 7 days of case investigation completion or summary information required within 21 days.

C. Local Health Jurisdiction Investigation Responsibilities

1. Begin investigation when the suspected human exposure to rabies is reported.
2. Counsel the patient and/or health care provider regarding the risk of rabies exposure and need for rabies PEP.
3. As appropriate, facilitate the capture and 10-day confinement of dogs, cats, and ferrets involved in a human exposure (see Section 5).

4. Facilitate transport of animal heads for rabies testing to the Washington State Department of Health Public Health Laboratories. Call CDES at 206-418-5500 prior to submitting specimens.
5. Report all *confirmed* and *suspect* cases to CDES (see definitions below). Complete the suspected rabies exposure case report form (<http://www.doh.wa.gov/notify/forms/rabiesexp.pdf>) and enter the data into the Public Health Issues Management System (PHIMS).

Note: Animal bites for which rabies exposure is not suspected are not reportable to either the local health jurisdiction (LHJ) or to CDES. If the LHJ receives such reports and chooses to track these in PHIMS, the same form can be used but these cases should be classified as “Not reportable.”

2. THE DISEASE AND ITS EPIDEMIOLOGY

Background

Rabies virus causes acute encephalomyelitis in mammals, including humans, and the outcome is virtually always fatal. In the United States, an average of two to three human rabies deaths are reported per year. During the past 25 years, two human rabies cases have been diagnosed in Washington. For more information on human rabies, please see the *Surveillance and Reporting Guidelines* for Rabies found at: <http://www.doh.wa.gov/notify/guidelines/pdf/rabies.pdf>.

A. Etiologic Agent

The disease is caused by the rabies virus (Family *Rhabdoviridae*, genus *Lyssavirus*). In the United States, there are several rabies virus variants (strains) circulating among reservoir hosts including raccoon, fox, skunk, and bats.

B. Description of Illness in Animals

Rabid animals can show a range of symptoms, often described as either “dumb” or “furious” rabies; an animal may progress from one state to the other. Dumb rabies is characterized by reclusive behavior, drooling, anorexia, a startled response to sudden noise or light exposure, and frequent licking and biting of the site of the bite due to irritation there. Furious rabies is marked by excitation and marked aggressiveness, notably biting of objects, animals, humans, or even self. Salivation can be profuse due to difficulty swallowing and there is often a change in vocalization (e.g., dog develops an unusual bark). Central nervous system signs of rabies may include paralysis, poor coordination, convulsions and coma. Wildlife may lose their fear of people; animals normally active only between sunset and sunrise may be seen during daylight hours. Infected bats may act strangely (e.g., crawling, hissing).

C. Reservoirs

In Washington, Oregon, and Idaho, bats are the primary reservoir species, and other animals (notably potential bat predators such as foxes or cats) are infected only as rare “spillover” from rabid bat populations. In other parts of the United States, skunks, raccoons, and foxes are important reservoirs (in addition to bats). In some parts of the world, dogs as well as other carnivores are important reservoirs.

D. Animals Rabies in Washington State and the Pacific Northwest

Bats are the only known reservoir for rabies in Washington State and rabid bats are found throughout the state. The percentage of bats in the wild that are infected with rabies is very low (less than 1%), however 5–10% of the sick and injured bats submitted for testing in Washington are rabid (see Table 1). During the past few decades, rabies has also occurred in animals other than bats (Table 2).

Bats are also the primary reservoir for rabies in Oregon, Idaho, and British Columbia. However, during 2000–2007, rabid non-bat animals were detected in these states and province. Oregon identified six rabid foxes with bat-variant rabies during 2000–2007. Idaho detected a rabid bobcat in 2001 and a rabid skunk in 2004, both with bat-variant rabies. British Columbia found 4 skunks in a park in Vancouver in 2004 and a cat in 2007, all infected with bat-variant rabies. This clearly demonstrates that rabies in bats spills over to other wild animals, as well as domestic animals.

Table 1: Rabid Bats Detected in Washington, 2000–2010

Year	Rabid bats /Total bats tested (%)
2010	14/200 (7%)
2009	14/311 (5%)
2008	17/337 (5%)
2007	22/315 (7%)
2006	15/273 (5%)
2005	15/245 (6%)
2004	20/311 (6%)
2003	23/229 (10%)
2002	12/186 (6%)
2001	22/263 (8%)
2000	23/330 (7%)

Table 2: Rabid Non-Bat Animals and Rabies Strain Type in Washington, 1986–2010

Year	Animal type (County)	Rabies Strain
2002	Cat (Walla Walla)	Bat-variant
1994	Llama (King)	Bat-variant
1992	Horse (Franklin)	Unknown
1987	Dog (Pierce)*	Unknown: history of bat exposure

* infection was not confirmed at CDC

E. Modes of Transmission

Rabies may be transmitted when infected saliva or other potentially infectious material (such as central nervous system tissue) penetrates the skin or contaminates mucosa of a susceptible mammal. Although person-to-person transmission of rabies by bite or saliva has never been confirmed, rabies can be transmitted via corneal and organ transplantation. Limited evidence also suggests that rabies might be transmitted by exposure to very large amounts of aerosolized rabies virus (e.g., exposure to millions of bats in a cave, laboratory exposure to rabies virus). Rabies is not transmitted by contact with blood, urine or feces, or by touching fur. The virus becomes inactive with drying.

F. Incubation Period of Rabies in Animals

Based on observational studies, dogs, cats, and ferrets have an incubation period 6 months or less (dogs average 3 to 8 weeks; cats average 4 to 6 weeks). There is little information about incubation periods in other mammals. Variation in incubation period is

due to species exposed, size of viral inoculum, proximity of the bite to the nervous system, and virus variant.

G. Period of Communicability

Infected animals can transmit rabies when the infection has spread to the salivary glands, which typically occurs around or after the time that central nervous system (CNS) signs develop. The rationale for a 10-day confinement period for dogs, cats, and ferrets rests on this observed interval between viral shedding and onset based on experimental data with these species. If communicable at the time of biting, these species should develop CNS symptoms within 10 days. Confinement for animals other than dogs, cats, or ferrets is not appropriate because of a lack of information about period of communicability relative to symptoms.

3. CASE DEFINITIONS

A. Classification of “Suspected Rabies Exposure” in PHIMS

Confirmed:

- Animal exposed human and animal tests positive for rabies
- Bat exposure
- Public health agency recommends or concurs with post-exposure prophylaxis (PEP) administration based on risk assessment of exposure

Suspect:

- PEP given by health care provider (HCP) but exposure circumstances unknown

Not reportable (animal bites **without** suspected rabies exposure):

- Animal tests negative for rabies (regardless of whether PEP was started)
- Dog, cat, or ferret healthy after 10-day observation
- Person demands PEP even though exposure not deemed to have occurred and PEP not recommended by public health
- HCP administers PEP but public health risk assessment is that there was no exposure

Note: Animal bites for which rabies exposure is not suspected are not reportable to either the local health jurisdiction (LHJ) or to Communicable Disease Epidemiology Section, thus do not need to be recorded in PHIMS. However, if the LHJ receives such reports and desires to track these in PHIMS, the same form can be used but these cases should be classified as “Not reportable.”

4. DIAGNOSIS AND LABORATORY SERVICES

*Note: For information regarding laboratory diagnosis of **human rabies** (i.e., a person with symptoms consistent with rabies), please see the Surveillance and Reporting Guidelines for Rabies (<http://www.doh.wa.gov/notify/guidelines/pdf/rabies.pdf>).*

A. Diagnosis

Rabies testing in animals is done using a direct fluorescent antibody (DFA) test. There are no reliable, standardized ante-mortem (live animal) tests that can be used to confirm whether an animal is infected with rabies. Fresh brain tissue (brainstem, cerebellum, and hippocampus) is required for this test, so the animal must be euthanized. The whole bat, the head of a medium-sized animal (e.g., most dogs and cats), and only the brain of larger animals (e.g., cow or horse) should be refrigerated and shipped with regular cold packs as soon as possible after death. The bat or the head may be frozen if shipment of the specimen must be delayed. Avoid freeze-thaw cycles; if the animal is already frozen, keep it frozen until and during shipping. Tissues must not be fixed in formalin.

B. Tests Available at the Washington State Public Health Laboratories (PHL)

PHL will perform DFA testing on animals that have potentially exposed a human to rabies. Brain tissue from non-bat animals with evidence of rabies by DFA will be forwarded to CDC for testing with monoclonal antibodies to determine the variant of the rabies virus. All submissions must be pre-approved by Communicable Disease Epidemiology Section (CDES) at 206-418-5500.

In situations that involve animal-only exposures, without any potential humans exposed, the animal can be tested for a fee (about \$85) at Oregon State University Veterinary Diagnostic Laboratory 541-737-3261.

C. Specimen Collection

Guidelines for submitting specimens to the PHL can be found at:
<http://www.doh.wa.gov/notify/other/rabiesspecimenguidelines.pdf>.

Animal heads or whole bats must be shipped with a completed rabies specimen submission form (<http://www.doh.wa.gov/notify/forms/rabiesspec.pdf>). Prior approval must be obtained from CDES. Please call 206-418-5500 to arrange for testing.

5. ROUTINE CASE INVESTIGATION

The decision to test an animal and/or recommend rabies post-exposure prophylaxis (PEP) hinges on whether an exposure to rabies is suspected to have occurred. The determination should be based upon the following questions:

- Was there a human exposure?
- What is the risk that the animal in question was shedding rabies virus in the saliva at the time of the exposure?

Under the 2011 notifiable conditions rule revisions, the Washington Administrative Code (WAC) was modified such that reporting of all animal bites is no longer required; instead, only those in which human exposure to rabies is suspected are reportable to the local health jurisdiction (LHJ). Thus, the determination of whether there was an exposure to rabies may have already been made by the health care provider without the involvement of the LHJ. Therefore not all of the following steps will necessarily be a part of every case investigation. Also note that some providers may suspect that a rabies exposure did occur, but the LHJ may disagree after receiving the report and assessing the situation. In the event that the LHJ concludes that a human exposure to rabies has *not*

occurred, then the event (animal bite, scratch, etc.) does not need to be reported to Communicable Disease Epidemiology Section (see case classifications above).

A. Was there a human exposure?

An exposure requires that saliva or other potentially infectious material (such as central nervous system tissue) of an animal is introduced or potentially introduced into bite wounds, open cuts or abrasions in skin, mucous membranes (e.g., eyes, mouth or nose), or scratches. Limited evidence also suggests that rabies might be transmitted by exposure to very large amounts of aerosolized rabies virus (e.g., exposure to millions of bats in a cave).

Rabies is not transmitted by contact with blood, urine or feces, by touching fur, or by being sprayed by a skunk. The virus becomes inactive with drying.

Special Considerations for Bats

Bat mouths and teeth are very small, thus bat bites may cause only minor injury or may not leave any visible marks. In 1995, a human rabies case occurred in a Washington State resident who had found a bat in the bedroom approximately 2.5 weeks prior to illness onset (<http://www.cdc.gov/mmwr/preview/mmwrhtml/00038616.htm>). Family members had examined the person at the time the bat was found in the bedroom but found no evidence of a bite. All contact with and any situation in which a bat found in a room or bedroom with a person should be evaluated carefully as discussed below.

“The risk for rabies resulting from an encounter with a bat might be difficult to determine because of the limited injury inflicted by a bat bite (compared with more obvious wounds caused by the bite of terrestrial carnivores), an inaccurate recall of a bat encounter that might have occurred several weeks or months earlier, and evidence that some bat-related rabies viruses might be more likely to result in infection after inoculation into superficial epidermal layers. For these reasons, any direct contact between a human and a bat should be evaluated for an exposure. If the person can be reasonably certain a bite, scratch, or mucous membrane exposure did not occur, or if the bat is available for testing and is negative for presence of rabies virus, post-exposure prophylaxis is not necessary. Other situations that might qualify as exposures include finding a bat in the same room as a person who might be unaware that a bite or direct contact had occurred (e.g., a deeply sleeping person awakens to find a bat in the room or an adult witnesses a bat in the room with a previously unattended child, mentally disabled person, or intoxicated person). These situations should not be considered exposures if rabies is ruled out by diagnostic testing of the bat, or circumstances suggest it is unlikely that an exposure took place.” (<http://www.cdc.gov/mmwr/PDF/rr/rr5703.pdf>).

B. What is the risk that the animal in question was shedding rabies virus in the saliva at the time of the exposure?

The following factors should be assessed: (1) geographic location of exposure; (2) animal health and behavior; (3) animal vaccination status; (4) circumstances of exposure; (5) likelihood the animal could have been exposed to a rabid animal; and (6) can the animal be observed (dogs, cats, and ferrets only) or tested to determine the whether it was rabid. These elements of a rabies risk assessment are discussed in detail below. An algorithm

including these points is also available for use at:
<http://www.doh.wa.gov/notify/other/rabiesalg.pdf>.

1. Epidemiology of Animal Rabies in the Place Where the Exposure Occurred

The known epidemiology of rabies in the geographic location of exposure (e.g., in Washington, out-of-state, or out-of-country) must be considered when assessing a possible rabies exposure because the prevalence of rabies varies both by geographic area and by species within those places. For instance, canine variants of rabies have been eliminated in the United States, but canine variant strains are still maintained in dog-to-dog transmission cycles elsewhere in the world, so dog bites in some countries carry a much higher risk of rabies exposure than they do in the United States. Even within this country, certain rabies variants and associated animal reservoirs occur in geographically definable regions (www.cdc.gov/rabies/location/usa/surveillance/index.html). However, note that affected areas may expand or contract as a result of virus transmission and animal population interactions and, even in Washington, remember that animals from elsewhere could be brought into the state. If a person is exposed to an animal outside of Washington, the epidemiology of animal rabies in the area where the exposure occurred should be determined.

- a. **Bats:** Bats serve as a reservoir for rabies throughout Washington State and the United States.
- b. **Dogs, Cats and Ferrets:** Although rabies in dogs and cats is very rare in Washington, domestic animals can be exposed to rabies during encounters with wildlife. Even indoor pets can be exposed, since rabid bats in Washington have been found in people's homes. In 2002, a rabid cat was identified in Walla Walla with bat variant rabies. Nationally, more cats are reported to have rabies than dogs.
- c. **Wild Terrestrial Carnivores (raccoons, skunks, foxes, coyotes, wolves, bobcat-cat and wolf-dog hybrids, etc.):** Rabies has not been identified in wild carnivores tested in Washington in the past 25 years. However, DOH does not perform active surveillance for rabies in wild carnivores. Rabies testing is performed on the small number of wild carnivores that expose a human and are captured (see Appendix A). Wild carnivores in Washington can become infected with rabies from bats. Evidence of transmission of bat-variant rabies among non-bat species along with the possibility of translocation of rabid animals from other areas of the country has the potential to rapidly change the epidemiology of rabies in Washington. Because the period of rabies virus shedding in these animals is unknown, these animals must be euthanized and tested rather than confined and observed when they bite humans.
- d. **Rodents (mice, rats, squirrels, hamsters, etc.), Lagomorphs (rabbits, hares), and Opossums:** Rabies in rodents, lagomorphs, and opossums is very uncommon in the entire country. In the eastern United States, raccoon variant rabies occasionally spills over into large rodents, especially woodchucks (groundhogs). According to CDC's national surveillance data (1990-1996), woodchucks accounted for 93% of the 371 rabies cases among rodents. Inoculation experiments with opossums in the 1960s found these animals to be relatively resistant to the rabies virus.¹

¹Beamer PD, Mohr CO, Barr TRB. Resistance of the Opossum to Rabies Virus. Am J Vet Res 1960;21:507-10.

- e. **Livestock (cattle, sheep, goats, pigs, horses, llamas, etc.):** Although rabies in livestock is not common in Washington, animals can be exposed to rabies during encounters with wildlife. In addition, livestock that have been imported from areas of the United States where rabies reservoirs in skunks, raccoons and foxes exist should have rabies considered in the differential diagnosis of any acute, progressive, fatal neurological illness. In 1994, a rabid llama with bat variant rabies was identified in King County and in 1992 a rabid horse was identified from Franklin County (rabies variant unknown).

2. Animal Health and Behavior

- a. **Current animal behavior and health status:** Animals exhibiting unusual behavior that might be consistent with rabies (see Section 2B) are more likely to be rabid than animals acting normally. However, signs vary by species, can be either subtle or obvious, and can include sudden death with few or no symptoms. Signs of rabies among wildlife cannot be interpreted reliably. The animal behavior and health status are best evaluated by a veterinarian.
- b. **Previous history of biting:** Bites by animals with a history of menacing or biting may reflect the animal's aggressive personality rather than infection with rabies virus.

3. Animal Vaccination Status

- a. Vaccinated dogs, cats, and ferrets are unlikely to become infected with rabies. However, it is possible that veterinary records show the animal is currently vaccinated but it is not immune to rabies due to vaccine inefficacy, vaccine mishandling, or poor documentation. Rabies antibody titers do not indicate immunity. Even if an animal is currently vaccinated, rabies cannot be ruled out.
- b. Rabies vaccines given off-label to other species, including hybrids such as wolf-dog hybrids, are of unknown efficacy and should be disregarded when making a decision to recommend rabies PEP.

4. Circumstances of Exposure

- a. **Provoked versus unprovoked exposure:** An unprovoked attack by an animal is more likely than a provoked attack to indicate that the animal is rabid. Examples of a provoked bite include startling an animal, running or biking past an animal, trying to capture an animal, or removing food, water, or objects from the animal. Although bites from an injured animal are usually considered provoked, an animal ill with rabies may be more prone to trauma (e.g., being hit by a car due to poor coordination).

5. Likelihood the Animal Could Have Been Exposed to Another Rabid Animal

- a. **Feral/Stray Animals:** Feral animals that are living outside have an increased chance of being exposed to other rabid animals, such as bats, as compared to pets which are more likely to be under the owner's control (see indoor vs. outdoor below).
- b. **Indoor vs. Outdoor Animals:** Strictly indoor-only animals are unlikely to be exposed to a rabid animal, unless bats have been in the home. Thus, the likelihood of an indoor-only animal becoming rabid is much lower than animals that are allowed to go outside without supervision by owners, which may include roaming freely or

within the confines of an outdoor cage or fenced yard.

- c. **Animal import and/or travel history:** Animals that have recently (within the previous 6 months) traveled or lived in areas where rabies is endemic in wild carnivores are more likely to be infected than animals that have not left Washington. The risk of rabies differs elsewhere in the United States (e.g., raccoon rabies in the east coast, skunk rabies in central states) and internationally (e.g., dog rabies in parts of Asia, Africa, Central and South America, and the Middle East).

6. Can the animal be confined for a 10-day observation period (healthy-appearing dogs, cats, and ferrets only) or is the animal head available for testing?

- a. When possible, any healthy-appearing dog, cat or ferret (vaccinated or unvaccinated) that bites a person should be confined and observed for a 10-day period. Extreme care should be used to prevent exposure of additional persons to the confined animal.
 - If there is no change in health or behavior after 10 days, the animal was not shedding the rabies virus at the time of exposure and rabies PEP should not be recommended or can be discontinued if it was already started.
 - If signs of rabies develop or the animal dies during the observation period, the local health department should be notified and the animal should be tested for rabies. Furthermore, if the animal must be euthanized for humane reasons and a 10-day observation period is not possible, the animal should be tested for rabies.
- b. Because the period of rabies virus shedding in wild animals and hybrids (offspring of wild animals crossbred to domestic dogs and cats) is unknown, these animals must be euthanized and tested rather than confined and observed when they expose humans.
- c. It is not known how long livestock shed rabies virus, so the observation period cannot be applied to livestock. Potential human exposures should be evaluated on a case-by-case basis.

Consult Communicable Disease Epidemiology Section as needed (206-418-5500). For additional information, refer to the Compendium of Animal Rabies Prevention and Control (<http://www.nasphv.org/Documents/RabiesCompendium.pdf>) and the most current ACIP recommendations (<http://www.cdc.gov/mmwr/PDF/rr/rr5703.pdf> and <http://www.cdc.gov/mmwr/PDF/rr/rr5902.pdf>).

6. DECISION TO ADMINISTER RABIES PEP

The decision to administer rabies post-exposure prophylaxis (PEP) should be made between the health care provider and the patient. Rabies PEP is imperative for any person exposed to an animal that tests positive for rabies.

A. Bat Exposure

In all instances of bat to human contact where rabies transmission is under consideration, the bat in question should be collected if possible, and submitted for rabies testing. Rabies PEP is recommended for all individuals exposed to a bat, unless the bat tests negative for rabies.

B. Dog, Cat or Ferret Exposure

If the dog, cat, or ferret is not available for a 10-day observation period or testing, the decision to start prophylaxis is based on the circumstances of the exposure, the behavior of the animal and the history of the animal (see Section 5). PEP should be recommended if the animal was displaying unusual behavior that might be consistent with rabies or if the bite was unprovoked. In other situations, the patient and/or health care provider should be educated about the epidemiology of rabies in domestic animals in Washington to assist in their decision whether or not to start rabies PEP. This decision can be difficult since the risk of disease is low but the disease is nearly always fatal. If you have difficulty making a decision on PEP recommendation, Communicable Disease Epidemiology Section (CDES) is available for consultation (206-418-5500).

C. Wild Terrestrial Carnivore Exposure

According to the 2008 ACIP recommendations (MMWR 2008;57:RR-3), “Raccoons, skunks, and foxes are the terrestrial carnivores most often infected with rabies in the United States. Suggestive clinical signs of rabies among wildlife cannot be interpreted reliably. All bites by such wildlife should be considered possible exposures to rabies virus. Postexposure prophylaxis should be initiated as soon as possible following exposure to such wildlife, unless the animal is available for diagnosis and public health authorities are facilitating expeditious laboratory testing, or if the brain tissue from the animal has already tested negative.”

As discussed above, the risk of acquiring rabies after exposure to wild terrestrial carnivores in Washington is low (see Section 5B1c). If an animal cannot be captured, or the animal head is not testable, rabies PEP should be recommended if the wild terrestrial carnivore was displaying unusual behavior that might be consistent with rabies or if the bite was unprovoked. In other situations, the patient and/or health care provider should be educated about the epidemiology of rabies in wild terrestrial carnivores in Washington to assist in their decision whether or not to start rabies PEP. This decision can be difficult since the risk of disease is low but the disease is nearly always fatal. If you have difficulty making a decision on PEP recommendation, CDES is available for consultation (206-418-5500).

D. Rodent (mice, rats, squirrels, voles, etc.), Lagomorph (rabbits, hares), and Opossum Exposure

Rabies PEP is rarely indicated after a rodent, lagomorph, or opossum bite. If the animal was exhibiting signs consistent with rabies (see Section 2B) or the bite was unprovoked, test the animal head for rabies; if the animal is not available for testing, rabies PEP should be considered. The period of rabies virus shedding in these animals is unknown.

E. Livestock Exposure

There are no national guidelines for the management of livestock biting humans; each case should be evaluated on an individual basis.

7. RABIES POST-EXPOSURE PROPHYLAXIS

The essential components of rabies post-exposure prophylaxis (PEP) are wound treatment and the administration of both human rabies immune globulin (HRIG) [only for previously

unvaccinated persons] and a series of doses of rabies vaccine. “Administration of rabies PEP is a medical urgency, not a medical emergency. Incubation periods of greater than 1 year have been reported in humans.” Therefore, “when a documented or likely exposure has occurred, PEP should be administered regardless of the length of delay, provided that compatible clinical signs of rabies are not present in the exposed person” (<http://www.cdc.gov/mmwr/PDF/rr/rr5703.pdf>).

A. Wound Treatment

Immediately wash all bite wounds and scratches with soap and water and, if available, a virucidal agent such as povidine-iodine solution. Administer tetanus prophylaxis and measures to control bacterial infection as indicated.

B. Post-Exposure Prophylaxis (PEP)

Rabies vaccination should be administered according to the most current Advisory Committee on Immunization Practices (ACIP) recommendations. In July 2009, the ACIP released provisional recommendations to reduce the number of rabies vaccine doses given in the PEP series from 5 to 4 doses for unvaccinated persons who are immunocompetent. The Centers for Disease Control and Prevention (CDC) adopted these recommendations in March 2010 (<http://www.cdc.gov/mmwr/PDF/rr/rr5902.pdf>). Additional ACIP recommendations for preventing human rabies are available at: <http://www.cdc.gov/mmwr/PDF/rr/rr5703.pdf>.

Two cell-culture vaccines are available in the United States for rabies pre- and post-exposure prophylaxis in humans. They are equally safe and effective.

- Human diploid cell vaccine (HDCV) (Imovax®) is available from Sanofi Pasteur (1-800-822-2463) (<http://www.imovax.com/>).
- Purified chick embryo cell vaccine (PCEC) (RabAvert™) is available from Novartis Vaccines and Diagnostics (1-800-244-7668) (http://www.novartisvaccines.com/products-diseases/travel_vaccines.shtml).

Two manufactures provide HRIG (for post-exposure use only) in the United States.

- Imogam Rabies–HT available from Sanofi Pasteur (1-800-822-2463) (<http://www.imovax.com/>).
- HyperRab™ S/D available from Talecris Biotherapeutics Bayer Biological Products (1-800-243-4153) (<http://www.talecris-pi.info/inserts/hyperrab.pdf>)

The appropriate protocol for rabies post-exposure prophylaxis depends on the exposed patient's previous rabies vaccination history:

1. For people who have never been vaccinated against rabies:
 - One dose (20 IU/kg) of human rabies immune globulin (HRIG) is administered on day 0. If anatomically feasible, the full dose of HRIG should be thoroughly infiltrated into the wounds and surrounding tissues, such as the area of the face that was bitten. Any remaining volume should be injected intramuscularly at a site distant from vaccine administration; typically the deltoid muscles are reserved for vaccine and not used for administering HRIG. Use a sufficiently long needle to

assure intramuscular injections. HRIG should never be administered in the same syringe or in the same anatomical site as vaccine.

AND

- For immunocompetent persons only: **four** doses of cell culture rabies vaccine at 1 mL/dose administered intramuscularly in the deltoid muscle on days 0, 3, 7, and 14. Alternating deltoid sites may be more comfortable for the patient. The anterolateral aspect of the upper thigh can be used in infants/young children. Use a sufficiently long needle to assure intramuscular injections. Administration of the vaccine should avoid the gluteal region due to potential for diminished immunologic response.
- For persons who are immunosuppressed (see definition below*): **five** doses of cell culture rabies vaccine at 1 mL/dose administered intramuscularly in the deltoid muscle on days 0, 3, 7, 14, and 28. The anterolateral aspect of the upper thigh can be used in infants/young children. Use a sufficiently long needle to assure intramuscular injections. Administration of the vaccine should avoid the gluteal region due to potential for diminished immunologic response. After the fifth dose obtain one or more serum samples to test for rabies virus neutralizing antibody titers using rapid fluorescent focus inhibition test (RFFIT) to ensure an acceptable response has occurred. Titers can be obtained through:
 - Kansas State University (785)-532-4298
 - <http://www.vet.ksu.edu/depts/dmp/service/rabies/index.htm>
 - Atlanta Health Associates (770)-205-9091 or (800)-717-5612
 - <http://www.atlantahealth.net/>

* Immunosuppression can be due to a variety of conditions, including congenital immunodeficiency, bone marrow transplant, human immunodeficiency virus infection, leukemia, lymphoma, generalized malignancy or therapy with alkylating agents, antimetabolites, radiation or large amounts of corticosteroids. For some of these conditions, all affected persons will be immunocompromised; for others, health care providers will ultimately have to determine the degree to which the immune system is compromised. Certain medical conditions, such as renal failure, diabetes, asplenia, or cirrhosis, may increase the patient's risk for certain infectious diseases and, when such conditions are long-standing or associated with complications, may dampen the immune response of these patients and result in relative immunosuppression. The 5-dose vaccine regimen should be considered for patients with these conditions. Among the elderly lower immune response, though not a *lack* of response, may also warrant consideration of the 5-dose regimen. Consult Communicable Disease Epidemiology (CDES) as needed (206-418-5500).

Note: "If HRIG was not administered when vaccination was begun on day 0, it can be administered up to and including day 7 of the PEP series" (<http://www.cdc.gov/mmwr/pdf/rr/rr5902.pdf>). Beyond the seventh day, HRIG is not indicated because an antibody response to cell culture vaccine is presumed to have occurred.

2. For persons **with** previous pre-exposure vaccination or post-exposure prophylaxis:

If prior vaccinations were one of the ACIP-recommended regimens (with cell culture vaccines available in the United States after 1980) or if persons received another vaccine regimen **and** had a documented adequate rabies virus-neutralizing antibody response:

- Two doses of cell culture rabies vaccine (1 mL) administered intramuscularly in the deltoid muscle on days 0 and 3 after a rabies exposure.
- HRIG should not be administered to previously vaccinated persons to avoid possible inhibition of the relative strength or rapidity of an expected anamnestic response.

C. Timing of Rabies Post-Exposure Prophylaxis

All wounds from potentially rabid animals should be immediately cleaned as described above. National recommendations are that persons bitten by animals known or suspected to be rabid should be given HRIG and vaccine urgently since the time which can pass between an exposure and effective administration of HRIG and vaccine is unknown.

Factors to consider when determining the speed of administering HRIG and rabies vaccine include the likelihood that rabies was transmitted and the anatomic proximity of the bite to the central nervous system. For high-risk bite situations, if the animal can be tested within 24 hours, then PEP can be delayed until testing results are available. However, if animal testing is substantially delayed, PEP should be started and can be discontinued later if results are negative. In lower-risk situations, initiation of PEP can be delayed until the 10-day observation (dog, cat and ferret only) or testing of the animal is complete. Washington State Public Health Laboratories (PHL) will usually have animal testing results within one working day of specimen arrival. If you have difficulty deciding whether or not to delay PEP until the animal is tested, consult CDES (206-418-5500).

D. Deviations from Recommended Vaccination Schedules

Arrangements should be made so that patients do not deviate from the recommended PEP vaccination schedule. However, occasionally lapses are unavoidable. If a delay of a few days occurs, vaccination schedule should be resumed as if the patient were on schedule. When longer delays occur, serologic testing should be preformed 7 to 14 days after the final dose in the series to assess immune status.

E. Post-Exposure Prophylaxis outside the United States

Patients exposed to rabid animals in foreign countries may start a PEP regimen with a vaccine that is unavailable in the United States. These vaccines may include purified vero cell vaccines (e.g., VerorabTM, Imovax – Rabies veroTM, or TRC VerorabTM), purified duck embryo vaccine (e.g., Lyssavac NTM), and different formulations of human diploid cell vaccine (e.g., RabivacTM) or purified chick embryo cell vaccine (e.g., Rabipur[®]). The regimens for PEP using these vaccines may differ from the regimen used in the United States, particularly if the vaccines are administered intradermally rather than intramuscularly.

“If postexposure prophylaxis is initiated outside the United States using one of these regimens or vaccines of nerve tissue origin, additional prophylaxis might be necessary

when the patient presents for care in the United States. State or local health departments should be contacted for specific advice in such cases. Rabies virus neutralizing antibody titers from specimens collected 1 to 2 weeks after pre-exposure or postexposure prophylaxis would be considered adequate if complete neutralization of challenge virus at a 1:5 serum dilution by RFFIT occurs.” (MMWR 2008;57:RR-3).

When possible, request by e-mail or fax a photograph or copy of the packaging from the vaccine that was administered abroad and any health care visit notes, documentation of vaccine administration, or receipts from the health care visit. This documentation may aid in the assessment of whether additional prophylaxis is necessary.

Be aware that counterfeit pharmaceuticals are not uncommon in some parts of the world. If you are confident that the vaccine was a bona fide cell culture vaccine, then either the full series can be accepted or any remaining doses needed in the series can be continued using cell culture vaccine in the United States; serology is not warranted. Neutralizing antibody titers by RFFIT should be checked if there were any significant deviations in the prophylaxis schedule or if a non-cell culture vaccine was used. Consult with DOH Communicable Disease Epidemiology Section as needed (206-418-5500).

F. Adverse Reactions Associated with Post-Exposure Prophylaxis

Prophylaxis should not be discontinued due to reactions without considering the patient's risk of acquiring rabies. Health care providers should report any unusual or severe adverse reaction attributed to HRIG or vaccine to the local health jurisdiction, which should notify CDES, and to the Vaccine Adverse Events Reporting System (VAERS: <http://vaers.hhs.gov/>), as well as to the vaccine manufacturer.

For additional information, please refer to **both** current ACIP recommendations for preventing rabies in humans: <http://www.cdc.gov/mmwr/PDF/rr/rr5703.pdf> and <http://www.cdc.gov/mmwr/PDF/rr/rr5902.pdf>.

8. MANAGING SPECIAL SITUATIONS

A. Dogs, Cats, or Ferrets Exposed to a Potentially Rabid Animal

When a domestic animal has direct contact with a rabid or suspect rabid wild animal, it is considered to have had a potential exposure to rabies. It is very important to capture and submit such wild animals for rabies testing if possible. Note that animal-only exposure testing is referred to the Oregon State University Veterinary Diagnostic Laboratory (see Section 4B) with costs paid by the domestic animal owner.

If the exposed dog/cat/ferret is currently vaccinated (see Section 8C) against rabies:

1. Immediately take the animal to a veterinarian for a booster rabies vaccination.
2. Confine the dog, cat, or ferret under the owner's control and close observation for 45 days. The animal should be kept at home or in a building, pen, or escape-proof enclosure. The animal should only be removed from confinement on a leash and under supervision of a responsible adult.
3. Any sign of illness or behavioral change should be reported to the local health jurisdiction immediately and the animal should be taken to a veterinarian. If the

veterinarian thinks the symptoms are suggestive of rabies, the animal should be euthanized and tested for rabies.

If the exposed dog/cat/ferret has never been vaccinated against rabies:

1. Consider immediate humane euthanasia; OR
2. Set up strict quarantine of the animal for 180 days (6 months).
 - a) If the quarantine is in an animal control or veterinary facility, the owner should be made aware of the cost, and the facility should agree to the terms of confinement as decided by the local health officer.
 - b) If the quarantine is at home, it should be set up with double door/gate enclosures to prevent against escape and it must prevent any direct contact of the animal with people and other animals.
 - c) A veterinarian should vaccinate the animal against rabies either on entry into the quarantine, or 1 month prior to release, to assure that the animal is currently immunized when released.
3. Any sign of illness or behavioral change should be reported to the local health jurisdiction immediately and the animal should be taken to a veterinarian. If the veterinarian thinks the symptoms are suggestive of rabies, the animal should be euthanized and tested for rabies.

Animals that have been vaccinated in the past but are overdue for rabies vaccines should be handled on a case-by-case basis (e.g., severity of exposure, time elapsed since last vaccination, number of prior vaccinations, current health status, local rabies epidemiology). There are currently no USDA licensed biologics for post-exposure prophylaxis of domestic animals, and there is evidence that the use of vaccine alone will not reliably prevent the disease in these animals.

B. Livestock Exposed to a Potentially Rabid Animal

Livestock that are currently vaccinated with a vaccine approved by USDA for that species should be revaccinated immediately and observed for 45 days following exposure to a potentially rabid animal. Consult public health veterinarian on such exposures. The DOH Environmental Health-Zoonotic Disease (EH-ZD) Program is available Monday through Friday during office hours only (360-236-3385); if unable to reach EH-ZD veterinarian, consult the Communicable Disease Epidemiology Section (206-418-5500).

C. Rabies Vaccine for Animals

There are formulations of rabies vaccine licensed for cats, dogs, and ferrets, as well as horses, cattle, and sheep. An animal's vaccine status is up-to-date if the initial vaccination was administered at least 28 days previously or booster vaccinations have been administered in accordance with the most current *Compendium of Animal Rabies Prevention and Control* (<http://www.nasphv.org/Documents/RabiesCompendium.pdf>). A booster vaccination should be administered 1 year after the initial vaccination regardless of the animal's age at first vaccination. An animal is considered currently vaccinated immediately after a booster vaccination.

D. Exposure to a Human with Rabies

Although person-to-person transmission of rabies by bite has never been confirmed, rabies PEP is recommended for persons who have exposure (Section 5A) to a human with rabies. Consult with Communicable Disease Epidemiology Section (206-418-5500) regarding PEP of persons exposed to a human with rabies.

9. ROUTINE PREVENTION

A. Human Pre-exposure Immunization

Rabies pre-exposure vaccinations are administered to individuals such as laboratory workers testing for rabies virus, veterinarians and their staff, wildlife biologists, rehabilitators, animal control officers who routinely have contact with stray domestic, exotic, and/or wild animals, and travelers staying for prolonged periods in rabies enzootic areas where medical care may be difficult to obtain. Pre-exposure immunization consists of three cell culture rabies vaccinations given on days 0, 7, and 21 or 28. For information regarding checking rabies titers, see the most current ACIP recommendations (<http://www.cdc.gov/mmwr/pdf/rr/rr5902.pdf>).

B. Prevention Recommendations

1. Be a responsible pet owner

- Keep vaccinations up-to-date for all dogs, cats and ferrets. This is important not only to keep your pets from getting rabies, but also to provide a barrier of protection to you, if your animal is bitten by a rabid wild animal.
- Keep your pets under direct supervision so they do not come in contact with wild animals. If your pet is bitten by a wild animal, seek veterinary assistance for the animal immediately.
- Call your local animal control agency to remove any stray pets from your neighborhood. They may be unvaccinated and could be infected by the disease.
- Spay or neuter your pets to help reduce the number of unwanted pets that may not be properly cared for or regularly vaccinated.

2. Avoid direct contact with unfamiliar animals

- Enjoy wild animals (e.g., raccoons, skunks, and foxes) from afar. **Do not** handle, feed, or unintentionally attract wild animals with open garbage cans or litter.
- **Never** adopt wild animals or bring them into your home. **Do not** try to nurse sick wild animals. Call animal control or a wildlife rescue agency for assistance.
- Teach children **never** to handle unfamiliar animals, wild or domestic, even if they appear friendly. "Love your own, leave other animals alone" is a good principle for children to learn.
- Prevent bats from entering living quarters or occupied spaces in homes, churches, schools, or other similar areas, where they might come in contact with people or pets.
- When traveling abroad, avoid direct contact with wild animals and be especially careful around dogs in developing countries. Rabies is common in developing countries in Asia, Africa, and Latin America where dogs are the major reservoir of

rabies. Before traveling abroad, consult with a health care provider, travel clinic, or your health department about the risk of exposure to rabies, pre-exposure prophylaxis, and how you should handle an exposure, should it arise.

3. Keep bats out of your home

Some bats live in buildings, and there may be no reason to evict them if there is little chance for contact with people. However, bats should always be prevented from entering living areas of your home. For assistance with “bat-proofing” your home, contact an animal control or wildlife conservation agency. If you choose to do the “bat-proofing” yourself, here are some suggestions:

- Carefully examine your home for holes that might allow bats entry into your living quarters. Any openings larger than a quarter-inch by a half-inch should be caulked.
- Use window screens, chimney caps, and draft-guards beneath doors to attics, fill electrical and plumbing holes with stainless steel wool or caulking, and ensure that all doors to the outside close tightly.
- Additional "bat-proofing" can prevent bats from roosting in attics or buildings by covering outside entry points. Observe where the bats exit at dusk and exclude them by loosely hanging clear plastic sheeting or bird netting over these areas. Bats can crawl out and leave, but cannot re-enter. After the bats have been excluded, the openings can be permanently sealed.

ACKNOWLEDGEMENTS

This document is a revision of the Washington State Guidelines for Notifiable Condition Reporting and Surveillance published in 2002 which were originally based on the Control of Communicable Diseases Manual (CCDM), 17th Edition; James Chin, Ed. APHA 2000. We would like to acknowledge the Oregon Department of Human Services for developing the format and select content of this document.

References: www.cdc.gov/rabies

UPDATES

January 2011: First issuance of this guideline. Prior to 2011, similar content was provided in the “Animal Bites and Rabies PEP” guideline. The Legal Reporting Requirements section reflects the 2011 Notifiable Conditions Rule revision.

APPENDIX A

Washington State Animals Tested for Rabies, 1988-2010

(Rabid animals in parentheses)

Year	Bat	Cat	Dog	Ferret	Raccoon	Skunk	Rodent	Lago-morph	Other Wild	Other Domestic	Total
1988	69 (4)	165	110	15	16	3	12	2	5	3	400
1989	102 (9)	124	91	20	9	4	8	1	9	4	372
1990	63 (4)	104	82	5	7	5	5	1	14	4	290
1991	90 (9)	105	96	13	8	3	13	0	19	2	349
1992	73 (6)	132	90	16	14	2	12	0	14	6 (1)*	359
1993	68 (1)	122	95	8	4	8	16	2	10	13	346
1994	58 (14)	105	90	7	4	3	15	0	16	14 (1)^	312
1995	263 (15)	140	114	12	8	1	23	3	15	18	597
1996	257 (13)	104	101	8	9	2	14	3	20	12	530
1997	780 (51)	155	118	7	17	4	15	2	18	11	1127
1998	447 (27)	126	109	8	11	1	6	0	19	16	743
1999	334 (25)	103	71	3	11	3	8	1	14	13	561
2000	330 (23)	105	60	1	2	4	6	1	9	4	522
2001	263 (22)	111	93	2	3	1	8	0	4	5	490
2002	186 (12)	99 (1)	53	7	2	2	9	1	8	9	376
2003	229 (23)	137	72	0	11	1	4	1	9	10	474
2004	311 (20)	141	70	3	13	6	11	0	6	10	571
2005	245 (15)	132	66	3	12	2	5	1	10	4	480
2006	273 (15)	105	70	4	13	1	2	1	8	5	482
2007	315 (22)	132	97	1	16	3	5	0	9	3	581
2008	337 (17)	143	76	1	10	2	5	1	9	11	595
2009	311 (14)	133	90	1	12	5	4	1	7	9	573
2010	200 (14)	104	64	0	14	1	6	1	9	10	409
Total 1988-2010	5604 (375)	2827 (1)	1978	145	226	67	212	23	261	196 (2)	11539 (375)
<p>* Horse ^ Llama Rodents include: beaver, chinchilla, chipmunk, degu, gerbil, gopher, hamster, marmot, mouse, muskrat, nutria, porcupine, prairie dog, rat, squirrel, vole, woodchuck Lagomorphs include: rabbit and pika Other domestic include: burro, cattle, goat, horse, llama, mule, pig, sheep, zebra Other wild include: badger, bear, bison, bobcat, cougar, coyote, deer, fox, kinkajou, lynx, marten, mink, mole, monkey/non-human primate, ocelot, opossum, otter, seal, shrew, weasel, wolf, wolf-hybrid, zorilla (striped polecat)</p>											